

STUDENT WORKBOOK**DETAILED LESSON OUTLINE**

COURSE:	Intelligence Support (INTS)
UNIT:	4 – Overview and Use of the WIMS / NFDRS
SUGGESTED TIME:	1 Hour
TRAINING AIDS:	Computer with projector, electronic presentation, student workbook
OBJECTIVES:	Upon completion of this unit, the student will be able to: <ul style="list-style-type: none">• Discuss several NFDRS indices or components.• List several applications of NFDRS outputs.• Recognize the relationship between WIMS and NFDRS.

I. NFDRS – NATIONAL FIRE DANGER RATING SYSTEM

Previous sections have presented information regarding fire operations, fire weather, and operational implications associated with each. There are a number of analysis systems or tools available to help fire managers with their activities and decisions, and the selection of which to use depends on what is being considered. This unit provides an overview of NFDRS, the National Fire Danger Rating System.

Background and History

Historically, fire danger rating had been discussed only in general terms. Anyone could apply their own scale or weighting to various fuels, weather, topography, and risk factors, and create their own fire danger rating system. Which is exactly what happened as agencies and organizations developed their fire protection capabilities during the first half of the 20th century.

In August of 1910, one of the most devastating forest fires in recorded American history burned much of northern Idaho and western Montana. Three million acres of natural forests burned in only 2 days, and at least 78 firefighters and 7 civilians lost their lives.

The fire events of 1910 demonstrated to managers the need to predict the potential for large fire activity, and pioneering efforts in fire danger rating research began about 1922. By the late 1950s, there were at least 8 different systems being used by the Forest Service, plus numerous other systems being used by state and private protection organizations. In 1958, a decision was made to undertake an effort to develop a single fire danger rating system to be used throughout the country.

In the late 60s and early 70s, work began on a fire danger rating system that would provide consistency among protection agencies and be built around science and engineering principles rather than local observations. In 1972, the first version of the National Fire Danger Rating System was released for general use by agencies throughout the United States. This version was a manually operated system consisting of various lookup tables and nomograms. In 1975, an automated version of the NFDRS was made available on a nationally accessible time-share computer system called AFFIRMS. After several modifications and enhancements, the current version of NFDRS was released in 1978. The 1988 modifications to the system were in response to concerns raised by users in the southeastern part of the country and included better recognition of how fuel moistures change during periods of drought and precipitation.

In 1993, the AFFIRMS system was replaced by WIMS as the processor of fire danger information and is currently being used by most state and federal agencies. Several private vendors have incorporated the NFDRS computer code in PC-based software programs that are being used by some state and federal agencies.

Key Assumptions

During the development of the NFDRS, several key assumptions were made:

- *Outputs relate only to the potential of an initiating fire, one that spreads without crowning or spotting through continuous fuels on a uniform slope*
- *Outputs address fire activity from a containment standpoint*
- *Ratings are relative and linearly related*
- *Ratings represent near worst case conditions*

Definitions

Before one can discuss fire danger rating, it must be defined. The most commonly accepted definition of **fire danger** today is “The resultant descriptor of the combination of both constant and variable factors which affect the initiation, spread, and difficulty of control of wildfires on an area”. The various factors of fuel, weather, topography, and risk are combined to assess the daily fire potential on an area. Fire danger is usually expressed in numeric or adjective terms.

Fire danger rating of an area gives managers a tool to assist in the day-to-day fire business decisions, but it must be considered along with local knowledge of the area. Fire danger ratings are typically reflective of the general conditions over an extended area affecting an initiating fire.

Fire danger rating areas consist of a geographic zone within which fire danger can be assumed uniform. These areas are relatively homogenous in fuels, weather, and topography. In NFDRS, the fire danger rating area is the foundation for making decisions on the ground.

NFDRS Components

There are many parts to a fire danger rating system. It is a complex mixture of science, technology, and local experience. The five key components of a fire danger rating system are:

- Mathematical models
- Data gathering system
- Processing system
- Communication system
- Data storage system

Basic Structure of the NFDRS

The structure of the NFDRS is quite simple. There are three major parts: scientific basis, user-controlled site descriptors, and data.

- **Scientific Basis**
- **User-Controlled Site Descriptors.**
- **Data**

NFDRS Processors

NFDRS calculations were originally performed by hand, using look-up tables and nomograms. These were replaced by handheld programmable calculators and mainframe computers. Today, there are three types of processors used to produce NFDRS outputs:

- Private vendor PC software for office use
 - **Fire Weather Plus** – Forest Technology Systems (<http://www.ftsinc.com/>)
 - **Weather Pro** – Remsoft, Inc. (<http://www.remsoft.com/>)
- Interagency PC software for office use
 - **FireFamily Plus**
(<http://www.fs.fed.us/fire/planning/nist/distribu.htm#Software>)
- **WIMS:** A link to the Weather Information Management System can be found on the Fire & Aviation Web Applications site (<http://famweb.nwcg.gov/>). WIMS is a comprehensive system that helps users manage weather information. Most federal and state fire and resource management agencies use WIMS to calculate their daily fire danger ratings. WIMS receives hourly fire weather data from remote automatic weather stations (RAWS) via satellite, non-satellite automatic weather stations (AWS) via a phone modem hub, and manual weather stations via manual entry.

NFDRS Outputs

The NFDRS calculations result in two types of outputs. These are intermediate outputs that serve as the “building blocks” for the next day’s calculations and the indices and components that actually measure the fire danger.

- **Intermediate Outputs**

- Live *Fuel Moisture* (Herbaceous and Woody)
- Dead *Fuel Moisture* – NFDRS models these values based on inputs such as precipitation and relative humidity

1-hr (<1/4”) 10-hr (¼ - 1”) 100-hr (1-3”) 1000-hr (3-8”)

- **Indices and Components:**

- *Ignition Component (IC)*
- *Spread Component (SC)*
- *Energy Release Component (ERC)*
- *Burning Index (BI)*
- *Keetch-Byram Drought Index (KBDI)*

Application of NFDRS Outputs

How fire danger is applied to the decision-making process is dependent on the decisions to be made. Some applications include:

- Determine staffing level
- Preplan dispatch actions
- Determine daily adjective rating
- Guide restriction of industrial activities
- Guide public use restrictions
- Determine regional Preparedness Level
- Support severity requests
- Assist in wildland fire use “go / no-go” decisions
- Facilitate briefings

Conclusion

One final thought -- Fire danger is often confused with fire behavior, but it's important to recognize NFDRS is not a replacement or substitute for the FBPS. There are a number of differences that must be kept in mind when working with either system, as shown on the handout you've been given. The principle difference is that fire danger is a broad scale assessment while fire behavior is site specific.

III. REFERENCE MATERIAL

“WIMS for Beginners” – A tutorial distributed as part of the prework for S-491 which walks the student through basic WIMS functions and describes their applications. Also taught in conjunction with “Basic NFDRS for Fire Managers”, which provides hands-on experience in accessing data in WIMS.

Local WIMS courses – Short, target-specific training presented by local personnel knowledgeable with WIMS.

“Gaining an Understanding of the National Fire Danger Rating System” – Publication explains the basic concepts of the NFDRS and provides background material on the history, components, maintenance, and application of the NFDRS. Available for order from regional caches (PMS 932 / NFES 2665). Also available in PDF format at <http://www.nwcc.gov/pms/pubs/pubs.htm>.

“WIMS Web Application User Guide” – Guide contains information about how to access and use the Weather Information Management System (WIMS). Organized to help users locate and perform specific WIMS functions quickly and easily. Available in PDF format on the FAMWEB site.

FireFamily Plus – Software used to apply NFDRS to fire business management. Originally called FireFamily, the program was designed for the PC in the early 80s. Although useful, few people actually used the program due to the difficulty in retrieving data from WIMS and in converting it to be able to work with FireFamily. In 1999, the Windows version (called FireFamily Plus) was released by the Missoula Technology & Development Center. FireFamily Plus is an extremely powerful tool. It has the capability to analyze current and historical weather, and fire occurrence. Available to download at <http://www.fs.fed.us/fire/planning/nist/distribu.htm>.

Wildland Fire Assessment System (WFAS) – WFAS consists of national maps for selected fire weather and fire danger components of the NFDRS. NFDRS computations are based on once-daily, mid afternoon observations (2:00 PM LST) from the Fire Weather Network, which is comprised of over 1500 weather stations throughout the conterminous United States and Alaska. These observations are reported to WIMS where they are processed by NFDRS algorithms. Available at <http://www.wfas.net/>

Other Internet Sites

- Western Region Climate Center (<http://www.wrcc.dri.edu/>)
- Climate, Ecosystem, & Fire Applications (<http://www.cefa.dri.edu/>)
- National Weather Service (<http://www.nws.noaa.gov/>)
- Climate Prediction Center (<http://www.cpc.ncep.noaa.gov/>)
- National Interagency RAWs Network (<http://www.fs.fed.us/raws/>)